Cost benefit analysis for crime science: making cost-benefit analysis useful through a portfolio of outcomes

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COST-BENEFIT ANALYSIS FOR CRIME SCIENCE: MAKING COST-
BENEFIT ANALYSIS USEFUL THROUGH A PORTFOLIO OF OUTCOMES

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CHAPTER SUMMARY

Cost-benefit analysis is used increasingly in crime reduction and criminal justice evaluations yet remains a frustrating exercise that is easy to criticise and dismiss. Should the intangible costs of crime be included? Should local or national cost estimates be used? Are ‘saved’ police and criminal justice costs a benefit of prevented crime? Should anticipatory and diffused benefits plus displacement costs be included? Which benefit-cost ratios should be presented for which of a range of diverse audiences? How long does crime prevention last, and so how many years of benefit-returns should be assessed? In theory, such questions could lead to a frustratingly large, perhaps infinite, number of benefit-cost ratio outcomes. Yet most studies present a single benefit-cost ratio measure. This study proposes a limited portfolio of benefit-cost ratios to convey information to a range of audiences and promote transparency. The argument is illustrated by a case study of a burglary reduction scheme.

INTRODUCTION

Cost-benefit analysis (CBA) is a technique used in most areas of public policy research including health, economics, and engineering. It is becoming increasingly commonplace in crime prevention and criminal justice research, and is increasingly influential in policy-making. The Home Office mandated that all evaluations for its recent multi-year nationwide Crime Reduction Program should incorporate cost-benefit analysis. The Home Office developed guides for evaluators to follow that encourage standardization of method (Dhiri and Brand 1999; Legg and Powell 2000; Colledge et al.1999). Similar guidance materials have been produced by the Canadian government (Hornich et al.2000).
2000) and the Office of Juvenile Justice and Delinquency Prevention of the US Department of Justice (Juvenile Justice Evaluation Center 2002). The European Community recently funded cost-benefit analysis of police traffic enforcement (Elvik 2001). As of mid-2004, the first in the list of the guiding principles of the National Institute of Justice of the US Department of Justice is to “Emphasize outcome and cost-benefit evaluations of criminal justice programs and technologies” (National Institute of Justice 2004). Estimating the costs of crime and using CBA in the evaluation of criminal justice is pursued by the New Zealand Ministry of Justice (MacCallum 1997) and the Australian Institute of Criminology (Roche 1999, Chisholm 2000; AIC 2003a, 2003b, Mayhew 2003) among others. All indicators suggest the influence of CBA in the development of crime policy will continue to increase significantly.

There has been rapid methodological progress in CBA in recent years. Significant innovation in the measurement of the intangible costs of crime (Cohen 1988, Miller et al. 1996) and other areas (see Cohen 2000 for a review) has spurred the inclusion of ‘intangibles’ in the most recent quasi-experimental evaluation research (Painter and Farrington 1999, 2001). The measurement of the costs of crime has major implications for policy makers in many areas including crime prevention, sentencing, and offender treatment policies. The reason is that, if the cost of crime is greater than previously thought, then crime prevention has commensurately greater value. For example, the high profile debate over the value of life that pervades some areas of public policy in the United States (Seelye and Tierney 2003; Hahn and Wallsten 2003) has potential implications for criminal justice programs addressing murder and its prevention. More
generally, there are implications for resource allocation within crime-related areas of policy as well as between various areas of public policy. If the aggregate cost of crime is higher than thought, funds that previously went to defence, transport, health, education or other tax-spending policies might be better spent on crime control. Hence, while the debate surrounding cost-benefit evaluation may appear solely technical to some readers, it is of potentially profound importance for the future of government.

**Previous CBAs**

Brandon Welsh and David Farrington have recently reviewed cost-benefit analyses of situational crime prevention projects, child development programmes, and correctional treatment programs (Welsh and Farrington 1999, 2000). Their extensive literature searches identified only thirteen situational crime prevention studies and nine correctional treatment studies. Though some studies will have been published in the interim, the reviews are a landmark in the literature as they provide a snapshot of what existed to that point. The reviews find little standardization in either the identification or measurement of cost items. Few evaluations include estimates of the intangible costs of crime. Some evaluations, such as that of the Kirkholt burglary project (Forrester et al. 1988, 1990), include the benefit from ‘saved’ police labour that is not spent investigating burglaries that were prevented, while most crime prevention evaluations exclude such cost items (but note that for the Kirkholt project, the benefits still significantly outweigh costs even when police time is excluded).³ Few studies included the benefits from potential long-run

³ We thank Emily Gillespie for an unpublished cost-benefit analysis that found the Kirkholt burglary project produced a positive benefit-cost ratio when saved police time was excluded from the original calculation. The same analysis also concluded that, if savings due to the intangible costs of prevented burglary were included, then the benefit-cost ratio would be higher than that in the published report.
returns that accrue from interventions that would have an effect for many years. Similarly, there are few cost-benefit evaluations that include measures of displacement or anticipation and diffused benefits (Smith et al. 2003; Bowers and Johnson, 2003), phenomena described later. To some extent, these issues reflect the changing state of knowledge but the more recent evaluations were not always more inclusive or sophisticated. Exceptionally, Painter and Farrington's series of cost-benefit evaluations of street lighting incorporates intangible costs, displacement and diffusion effects, and estimates of short and long-run returns (Painter and Farrington 1999, 2001).

Farrington and Welsh’s reviews draw conclusions that are disarmingly understated. The studies reviewed are, on the surface, comparable via the common metric of a benefit-cost ratio. However, it is clear that those ratios were derived from radically different measures and methods relating to varying cost items. It is also clear that there were so few studies that their aggregated findings are not self-evidently representative of interventions in either of the two fields. Possibly to avoid appearing to criticise CBA itself, Farrington and Welsh expertly avoid concluding that little is known, and that what is known is uncertain. However most readers will reasonably conclude that the discipline of CBA was floundering, characterised by an absence of studies, inconsistent method and measures, and that CBA had made at best a minor contribution in the fields of crime prevention and correctional treatment.

Cost-benefit analysis has been used in other areas of criminal justice. It has been used in policing (see e.g. Stockdale et al. 1999), in the assessment of drug policy (Caulkins
in a series of drug court evaluations (Roman and Harrell 2001, Harrell et al. 2000), in the assessment of developmental child improvement programmes (Greenwood et al. 1996, see Nagin 2001 for a review), in the assessment of a broad spectrum of crime policies (Aos et al. 2001), and in a variety of ad hoc evaluations of policies and programmes including a range of road safety efforts (ICF Consulting Ltd. 2003) and in assessing the cost-effectiveness of speed cameras and traffic lights (Hooke et al. 1996). Evaluations that relate to harm, suffering and quality of life such as housing, health and education, can contain some crime-related element. In other crime-related areas there are few reviews of the rigour of those conducted by Farrington and Welsh for situational crime prevention and correctional treatment. However, it is likely that, with the honourable exception of some of the more recent studies cited above, the rather negative conclusions are broadly applicable.

Broadly speaking, policy-relevant knowledge deriving from CBA is the exception rather than the rule in relation to crime and criminal justice. The paucity of relevant studies perhaps reflects the problems of methodology besetting CBA. Certainly in the experience of the present authors, this evaluation tool is frequently viewed with scepticism when applied in criminology. To paraphrase, we have variously heard CBA for crime prevention and criminal justice described as incomprehensible, misleading, open to widespread abuse or even, intrinsically useless.

Diverse explanations can be offered as to why CBA remains underutilised. Perhaps few criminologists have the methodological expertise to undertake the exercise - this is
certainly a concern of some economists who view CBA as their rightful property. However, accessible guides such as that of Dhiri and Brand (1999) can bring CBA to a fairly broad criminological audience. Second, CBA methodology has been rapidly evolving in relation to the costs of crime, potentially leaving many previous CBAs vulnerable to questions regarding the accuracy of their method. Third, perhaps results presented as a single benefit-cost ratio are inadvertently, or perhaps wilfully, misinterpreted by sectional interests so that even rigorous CBAs remain under-utilised. Greater methodological transparency in the development and presentation of results may help overcome these difficulties. The solution proposed herein is a limited portfolio of benefit-cost ratio outcome measures. A set of measures will allow different audiences with different needs to identify either the outcome measure most suited to their needs or to identify the range of estimates with parameters most suited to informing their policy-relevant decision. A portfolio could allow consumers of CBA to look at variation in the benefit-cost ratio according to whether or not intangible costs of crime are included, whether or not local or national cost estimates are used, whether or not ‘saved’ criminal justice costs are included, whether or not displacement, diffusion and anticipatory benefits are included, and for different anticipated rates of return over time with varying discount rates.

The Mathematics of Multiple Outcomes

The term ‘limited’ portfolio is used because although several benefit-cost ratios are advocated, they comprise only a small subset of those possible. This can be illustrated via a simple thought experiment: Consider that, in addition to some fixed capital cost, there
are six cost items which can each take one of two values. One item, intangible costs, can be either included or excluded from the analysis (perhaps by an insurer who wants to concentrate solely on financial costs). Another item is displacement costs that can be either included or excluded, and so on for the other variables in our hypothetical example. Each of our six variables can be used in one of two ways, so there are $2^6$ or 64 permutations of benefit-cost ratios to be calculated. However, if each cost item had three possible values, the number of permutations is $3^6$ or 729 benefit-cost ratios. With multiple continuous variables and confidence intervals, the number of possible benefit-cost ratios rises exponentially. The theoretical maximal case would approximate to infinity for all practical purposes. In practice therefore, there is a trade-off to be reached. The optimal portfolio should enhance transparency and allow a broad range of discerning readers with different interests, greater information on which to base a decision.

Increasing the amount of information available for decision-making is, after all, the aim of cost-benefit analysis.

It is not inconceivable that some insight, however limited, into the possible range of benefit-cost ratios is what causes scepticism among some consumers of CBA when presented with a single benefit-cost ratio. This can be characterised as the ‘It just doesn’t feel quite right’ syndrome. Without necessarily being familiar with specific methodologies or the intricacies of the particular calculation, many consumers of CBA have a strong intuition that, with so many variables and uncertainties, no single benefit-cost ratio can be appropriate.
Given an impossibly large number of benefit-cost ratios, a limited portfolio (nine main variables are discussed below) seems a modest enterprise. Note, however, the contrast to the other theoretical limiting case which has become a widely accepted norm, that is, the presentation of a single benefit-cost ratio measure.

For many of the parameters discussed below, the question regarding their inclusion or exclusion can intentionally be made into a moot point by the provision of cost-benefit information for both points of view. This is preferable not only because it allows highly opinionated readers to view the outcome from their particular perspective, but it gives transparency regarding the influence of particular variables, and allows the same readers to view the results from alternative positions. Hence, the provision of more information promotes transparency and, it is hoped, would facilitate a more informed debate of the relevant issues.

**The Thesis: A Portfolio of Benefit-Cost Ratios**

This section describes key variables that we propose warrant consideration in a portfolio of benefit-cost ratio outcome measures. It briefly reviews issues that make them contentious and which mean they are sometimes included in, sometimes excluded from, the presentation of benefit-cost ratios. The portfolio discussed here, as with the case study that follows, is anchored primarily in the specific field of crime reduction. With a crime reduction backdrop, the set of variables discussed below are neither exhaustive nor directly applicable to all criminal justice evaluations (since they will vary in their
specifics). We anticipate that other variables will warrant consideration in other fields. However, the notion of a portfolio of outcomes is of general application.

John Roman of the Urban Institute has identified concerns akin to those discussed herein (Roman 2004). Roman demonstrated how different impact evaluation methodologies can significantly influence outputs and outcomes. He compares the effect of changing comparison group, sample sizes and statistical analysis model (using examples for in-prison treatment evaluations where various statistical-control models could be selected). Roman finds that “Clearly, the cost-benefit model can yield wildly divergent results depending on what approach was taken.” (Roman 2004: 260). However, arguably Roman’s most sparkling observation is that particular rare events, such as some violent crimes (rape, murder), can sometimes wholly distort a CBA. This is due to the sheer magnitude of monetary equivalence that such crimes generate. For example, Miller et al. (1996: 9) estimate the ‘average’ murder costs $2.94 million whereas the average burglary costs $1,400, making a murder 2100 times more costly. Similar, though perhaps less exaggerated, effects can occur if a lesser crime is, for whatever reason, re-classified as a more serious event. John Roman writes:

“By moving a single crime from a felony to a serious felony, the direction and magnitude of the cost-benefit results can be fundamentally changed. Such is the power of the rare event”. (Roman 2004: 267).
Roman’s work also helps clarify the distinction between CBA influences that are determined at the stage of impact evaluation and those determined at subsequent stages of cost estimation for CBA. There is an important distinction between impact evaluation issues and pure cost-estimation issues. In the present study, the impact evaluation issues discussed are displacement, diffusion, anticipatory benefits, the confidence intervals around the impact size, and number of years over which crime prevention returns are estimated. Their inclusion or exclusion changes the perceived impact of the programme, which then subsequently play a role in the CBA. In contrast, those issues relating to input cost measurement, intangible costs, emotional costs and the cost of averted criminal justice expenditures are pure cost-benefit issues. To put this another way, the pure cost-benefit issues are not relevant to an impact evaluation while the impact evaluation issues will remain even in the absence of a CBA. In what follows, the issues are grouped into these two types.

A. Issues deriving from Impact Evaluation Technique
   
   i. Displacement and Diffusion of Benefits

Two areas in which the issue of agents is of major importance for many criminal justice evaluations are the diffusion of preventive benefits (Clarke and Weisburd 1994) and crime displacement (see Barr and Pease 1990; Eck 1993; Hesseling 1994; Hamilton-Smith 2003). Displacement refers to how crime can move elsewhere or adapt in the wake of preventive action, even if at a lower intensity. Diffusion generally refers to how crime in other areas or of other types is reduced as a positive knock-on effect of preventive action. When it comes to a burglary reduction initiative such as that discussed below, different agents are apparent. Local residents are primarily concerned with reducing the
rate of burglary where they live. Displacement is, for them, a matter of little direct concern. Similarly, diffusion of benefits (knock-on reductions in burglary in neighbouring areas) is irrelevant to them unless they can charge a fee to neighbouring residential communities, or get the neighbouring areas to return the favour. For the local police, and perhaps local and national governments, politicians and community agencies, the concerns are different. They are more concerned with aggregate effects, that is, all such knock-on effects combined. Yet police and government will have geographical limits to their interests. They will be far more interested if they are paying for the initiative since they want to determine the returns to the investment. Hence, the judgement whether either, neither or both of displacement and the diffusion of benefits provides essential information lies in the eye of the beholder. We here distinguish diffusion and displacement as variables measured separately from input and other costs. The presentation of results with and without these items is desirable because it conveys information in a way which speaks to the interests of the different parties involved. Distinguishing between types of diffusion and displacement also allows an informed assessment of the geographical and other variations in outcomes.

**ii. Anticipatory Benefits**

One further issue which is noteworthy here is a recently identified phenomenon known as *anticipatory benefit* (Smith et al., 2002). This occurs where reductions in crime occur in an action area in advance of preventive activity on the ground. A variety of reasons exist why such a pattern may emerge, but the most convincing explanation is that pre-scheme publicity generates a deterrent effect, discouraging offenders from committing crime in
the area (see Bowers & Johnson, 2003). The importance of this finding for evaluation research relates to the selection of the units of time (before and after) used to assess impact. Where this phenomenon occurs, when estimating outcomes, is it accurate to use an historic period of time which encapsulates the anticipatory epoch? This is debatable, but the authors suggest not, as it would have the effect of lowering the baseline crime rate, thereby making any quantification of outcome more conservative. If anticipatory benefits are a direct result of an intervention however, there is a strong argument for making them available as an aspect of the overall outcome measure.

**iii. Sustainability and Returns over Time?**

One matter considered too infrequently in crime reduction and criminal justice research is sustainability. How long will a set of crime reduction measures maintain an impact? Will security measures fall into disuse or disrepair? Will this be a gradual decay in impact over time or a sudden one-off drop? Many quasi-experimental evaluations have fairly arbitrary “before” and “after” periods, typically of one year or two years. In reality however, many interventions will have a continuing effect beyond the formal evaluation period. This can lead to an under-estimation of benefits. The issue of returns over time can also be problematic when a significant capital investment has been made towards the end of a project, since the time-constraint is particularly acute.

Returns over time is primarily an issue relating to impact evaluation. However, in the present context it can be considered as a benefit-cost issue because of the role of discounting in the calculation (and so it is presented as a benefit-cost issue in Table 1).
Discounting is an issue relevant to cost-benefit analysis which is typically not incorporated in impact evaluations. Discounting, in brief, refers to the fact that we have a preference for immediacy or a ‘rate of time preference’ (returns in the future are worth less so that, even with zero inflation, a pound this year is worth more than a pound in five years) as well as the fact that the interest rate means present values are greater than future values because the pound could be invested (see e.g. Gramlich 1990).

It would be useful for evaluations to generate benefit-cost ratios that incorporate potential long-run returns. The best example of such an analysis is that by Painter and Farrington (1999, 2001) in their work on street lighting. They produced benefit-cost ratios showing returns within one year, but also for a twenty year period (the estimated lifetime of the lighting). The twenty-year estimate incorporated maintenance and running costs as well as discounting the value of future returns.

iv. Are there Confidence Intervals?

Many ‘results’ in social science are estimates which embody some degree of uncertainty or imprecision. There is usually some possibility, however slight, that an outcome occurred other than the one that is our ‘best estimate’. A typical means of reducing such uncertainty is the use of confidence intervals. Confidence intervals give results as a range rather than a point-estimate. The spread is key: a narrow range gives greater certainty than a broad range. While a range may seem more imprecise, in fact there is greater precision derived from the reduced uncertainty. Using the typical confidence intervals of 95%, the reader can be 95% certain that the actual outcome lies somewhere between the
upper and lower boundaries. Yet relatively few crime reduction or other criminal justice
evaluations produce confidence intervals that circumscribe their main outcome estimates.
Since policy-makers and others are more informed insofar as they know the degree of
certainty with which findings can be viewed, there is a strong argument for the
production of confidence intervals which can, in a fashion akin to sensitivity analysis,
become confidence intervals around a benefit-cost ratio.

B. Pure Cost Estimation Issues

i. Who Pays Input Costs? Who Receives Benefits?

We begin with the well-known and uncontroversial issue of the existence of multiple
agents (touched on above in relation to displacement and diffusion). Society overall may
benefit from an initiative even if those paying the costs do not. Is this a desirable
outcome? A region could benefit from a major road funded by a particular city within it,
even though the city itself makes a significant loss (Boardman et al. 1996). What if a
private firm could introduce security that would benefit society as a whole but which
would not have much benefit for the firm? For example, a company may not find it
profitable to produce a safer product even though its production would reduce crime. In
such instances, the benefit-cost ratio that the company is examining is different from that
which ‘society as a whole’ is examining. The producer ignores costs from crime if, say,
their products are frequently stolen hot-products. Society is forced to count such crime
costs, which are arguably a form of pollution like any other (see Roman and Farrell 2002
for further discussion on crime pollution). Such examples illustrate the virtues of
presenting both (or more) sets of benefit-cost ratios that incorporate more than one
viewpoint. Typically this does not occur, the evaluation in consequence reflecting only the perspective of the funding agent.

**ii. National or Local Costs?**

Local crime reduction schemes will incur costs which vary according to area characteristics. Labour costs are frequently an important component of many projects, but vary hugely from one place to another. Paying a carpenter to secure households in north Manchester may be a significantly different monetary undertaking in south Wales or central London. Consider either particularly affluent or poor areas in which the average cost of a burglary is radically different from the national average: the potential returns might be significantly different elsewhere. There is thus an argument for the costing of items to, at minimum, both local and national average costs where available. This is easier for some cost items than for others. National estimates of the cost of crime are readily available and produced by the Home Office (see Brand and Price 2000), and so it should be a relatively straightforward matter to provide benefit-cost estimates that utilise local and national estimates.

While this is clearly within the realms of traditional sensitivity analysis within cost-benefit analysis, the specific instance of the costs of crime is particularly relevant to crime reduction and criminal justice evaluations. It is most appropriate where local costs vary significantly from national cost estimates in a fashion that could significantly affect the overall benefit-cost ratio. In short, however, providing benefit-cost ratios that include
both local and national cost estimates where available may prove a relatively simple means of providing information to audiences with different demands.

**iii. Should Intangible Costs be Included?**

A key issue arising in CBA for criminal justice in recent years has been the estimation of intangible costs. Intangible costs include emotional and psychological costs. For some crimes such as car theft, the intangible cost is typically low both in absolute terms and relative to the financial cost, and short-lived in duration. For crimes such as rape and murder however, the intangible costs are often huge (financial costs also often being significant) and enduring. There are two main areas of contention: The first is whether or not intangible costs should be estimated, and the second, if the answer to the first is in the affirmative, is *how* to produce accurate estimates.

Most previous studies do not include intangible costs simply because these have not been available for very long and because, like many new developments, they encountered some initial resistance. There is now decreasing scepticism regarding whether or not intangible costs should be estimated. Even victim advocates who initially had a knee-jerk reaction against putting a monetary value on pain and suffering have come to recognise that it is far worse to exclude such costs from evaluation exercises. To exclude them is to exclude a major part of the experience of the victims of crime. Further, exclusion of such costs means that the cost of an average burglary appears to be more than the cost of a rape – from most perspectives an indefensible position. However, when recent intangible cost estimates are included, rape is, as a statistical average, 62 times more costly than
burglary (Roman and Farrell 2002: 82). This seems more tenable. It is also readily apparent that society already places a value on pain and suffering when it estimates victim compensation awards (e.g. Michigan Judicial Institute, 2001). Yet there is still some understandable revulsion about placing a monetary value on rape for the impersonal purposes of cost-benefit analysis. Indeed, perhaps the only thing worse than placing a value on pain and suffering is not to do so, since this implies the default value of zero. The more intricate methodological arguments are that 'monetary value' is really only a proxy for 'utility units' (so we are not really using a monetary value at all), and that statistical averages are clearly not intended to reflect individual experience.

How to estimate intangible costs is a tricky methodological issue. Estimation methodologies are arguably in their early stages, with a need for much further research to provide competition for pioneering estimates of intangible costs such as those of Cohen (1988) and Miller et al. (1996). There is also a need for greater investigation of the range and confidence intervals of costs estimates and how they apply to different populations and contexts.

Although this has been only a very brief review of issues relating to intangible costs, and we do not conclude that all issues have been resolved, the key purpose of the present exercise is to propose a practical remedy, namely to make results available both with and without intangible costs. The consumer of CBA may thereby examine the variation in the results.
iv. Criminal Justice Costs?

The case can be made for either the inclusion or exclusion of ‘saved’ criminal justice costs. The argument for their inclusion is that, if crime is prevented, then there are no police costs responding to and investigating the crime, and no subsequent criminal justice costs for those cases that would otherwise be formally processed. These costs could include prosecution, court and prison or other sentencing-related costs for that proportion of cases which result in an arrest, charges and further case processing.

Many evaluations exclude criminal justice costs, reasoning that no costs would be saved. The number of crimes prevented for any small-scale project is, relative to the overall number of crimes, so trivial that police and other criminal justice costs remain the same: the police do not employ less labour or equipment and the criminal justice system does not shrink or save any costs. Yet there is also a case for their inclusion since, if small-scale demonstration projects are extended and produced the same results then, it could be argued, they would have a significant impact upon subsequent policing and criminal justice costs. To exclude such costs could be said to be similar to arguing that crime, or any set of local crimes, does not produce any criminal justice costs. A simple means to accommodate both sides of the coin, and to view the overall effect of criminal justice costs, is to present benefit-cost ratios with and without this cost item.

Promoting Consumer Choice

Based upon the discussion of the variables above, the possible number of permutations of outcome measures is horrendously large. The task, therefore, is to develop an optimal set
or portfolio of outcome measures that conveys the maximum amount of information in a transparent way and allows readers with different needs and perspectives to consider the most appropriate measures from their perspective.

**INSERT TABLE 1 ABOUT HERE: USER-SPECIFIC CBA**

In a world of increasing computerisation, the case can easily be made for a spreadsheet-type application that allows users to select parameters, and to include or exclude various cost items. Table 1 shows a simplified set of relevant variables and how they might vary in such an application. It is, of course, far easier to say this than to do it, as the reader will recognise in the case study that follows where we do not necessarily reach all of the goals specified in this more abstract discussion.

**CASE STUDY IN MIDTOWN**

The Midtown scheme was part of the national Reducing Burglary Initiative (RBI) which itself was a component of the Crime Reduction Programme initiated in 1999 by the Home Office. Other components of the programme included efforts to tackle domestic violence, to develop targeted (problem-oriented) policing, and to evaluate the impact upon crime of closed-circuit television. The RBI was a nationwide effort evaluated by three regional consortia (see Kodz and Pease 2003 for an overview of national-level findings). The data presented here is from one project in the northern region. Results from the analysis have been presented elsewhere (e.g. Johnson et al 2004; Johnson et al 2001; Bowers et al 2004). The interested reader is referred to those outlets for more general information as

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4 Midtown is a fictitious name to protect anonymity.
the focus of the present study is primarily upon the identification and development of benefit-cost ratio outcome measures.

This case study illustrates the limited portfolio of measures with data for one the Reducing Burglary Initiative scheme undertaken in the area of Midtown. The scheme was selected as one for which detailed cost data and crime reduction outcomes were available. The need to select a scheme on this basis highlights the fact that the collection and collation of the range of necessary data is not necessarily straightforward: extensive data collection can be a tricky and costly research activity. Indeed, there is an irony in the possibility that, for low-budget evaluation research in an atmosphere of scepticism regarding CBA, it may not appear cost effective to conduct a cost-benefit analysis!

The Midtown scheme undertook four different interventions;

- Installation of household target hardening security;
- An educational scheme to promote appropriate use of target hardening measures by householders;
- The installation of other situational measures in the local environment, primarily alley-gating (that is, large gates to close-off paths used by burglars) and;
- Offender-based strategies (intelligence led operations and disruption of the stolen goods market).

*Input Costs*
The overall ‘crude’ cost of the scheme was £142,415 which was composed of £28,173 funding from the Reducing Burglary Initiative and the remainder from levered-in sources. This was converted to a common price base at a common point in time (that is, April 1999), incorporating the time for which capital assets were utilised and their expected lifespan. After these adjustments, the overall economic costs of the scheme were £109,131. This allowed the use of a simple before-and-after approach to calculating burglary outcomes, rather than having to account for phased implementation. Expenditures upon components of the preventive effort are detailed in Table 2.

**INSERT TABLE 2 ABOUT HERE: INPUT COSTS**

**Costs of Burglary**

The value to society of a prevented burglary is a necessary component of the CBA. The national average cost to society of burglary in a dwelling in England and Wales was £2344 in the year 1999, the components of which are shown in Table 3 which is derived from the estimates of Brand and Price (2000; viii). As the most comprehensive such estimates currently available this estimate is used in the cost-benefit calculations that follow.

**INSERT TABLE 3 ABOUT HERE: COMPONENTS OF COST OF BURGLARY**
In the calculation of net benefits and benefit-cost ratios that follows, the cost of burglary was varied to account for possible different perspectives. Three measures are used: benefit measure 1 (BM1) of £2344 being the total as shown in Table 3. Benefit measure 2 excludes £550 equivalent of emotional and physical costs. This was the closest proxy to the exclusion of intangible costs that could be generated. Benefit Measure 2 therefore uses £1794 as the value of each burglary prevented. Benefit Measure 3 excludes, in addition, criminal justice and police costs estimated at £490, giving a value of £1304 for BM3.

Outcomes

i. Impact Evaluation and Confidence Intervals

The scheme was operational between September 1999 and September 2001. The outcome evaluation estimated that 308 burglaries were prevented over the two year period. To increase reliability, this point-estimate of burglaries prevented was set within statistical confidence intervals. The upper and lower 95% confidence intervals set the number of burglaries as between 262 and 355 burglaries (for the calculation of the confidence intervals see, Johnson et al., 2004). Including low or high estimates of outcome changes the magnitude of the benefit-cost ratios by 15 percent in either direction. For presentational simplicity, the confidence intervals are not shown in the main tables of net benefits or benefit-cost ratios as table size would triple. However, in reading those tables the reader should be aware that confidence intervals of 15 percent either side apply to the findings.
ii. Displacement and Diffusion

In the calculation of net benefits and benefit-cost ratios, three impact measures are used. Impact Measure 1 is the 308 burglaries prevented in the project area as described in the previous paragraph. Impact Measure 2 includes the net effect of displacement and diffusion. The net effect of displacement and the diffusion of benefits within the two years of the project was estimated to be an additional 37 burglaries prevented. When added to the 308 burglaries prevented in the project area, total burglaries prevented is 345 for Impact Measure 2. The anticipatory benefits generated by this project were estimated to be 419 additional burglaries prevented. Impact Measure 3 (IM3) is equal to IM2 plus burglaries prevented due to the anticipation effect, for a total of 764 burglaries prevented over the two years of the project.

iii. Returns over Time

Three scenarios of returns over time were identified for the CBA. The first scenario is the two years of the project period discussed above. The impact evaluation found that 136 burglaries were prevented in year 1 and 172 in year 2, for the total of 308 over two years. There is some justification for this time-limited estimate of returns that is restricted to the duration of the project’s funding period. In reality however, the crime prevention impact would continue after the cessation of project funding. Locks, bolts, alley-gating and other security measures would continue to be used, and the education components would arguably continue to influence householders. Even if the project’s police intelligence operations ceased to operate, they would have a residual effect if offenders continued to be deterred, remained incarcerated, or had been nudged into desistance.
To reflect the anticipated longer lifespan of the crime reduction tactics, two further scenarios of returns over time were developed. In the second scenario, burglary continued to be prevented after the two years of the project, but at a declining rate of 10 percent of the original prevention rate per year. That is, the number of burglaries prevented fell from 172 by 17.2 burglaries in year 3, a further 17.2 in year 4, and so on until no more burglaries were prevented after year 11 (nine years into the future). A total of 1082 burglaries were prevented in this scenario. Using a discounting rate of 6 percent the estimated total benefit from prevented burglaries ranged from £1.2M to £2.1M depending upon the value of a saved burglary that was used.

In the third returns scenario, burglary was prevented at the same rate as year 2 for a further nine years (which, although a somewhat arbitrary duration, facilitates some comparison between the second and third estimates). A total of 1856 burglaries were prevented in this scenario. Applying a discounting rate of 6 percent, the estimated total benefit from prevented burglaries ranged from £4.8M to £8.6M depending upon the value of a saved burglary that was used.

Although the third scenario could be suggested to be that of an extreme optimist, Painter and Farrington (1999) assumed that crime was prevented at the same rate for twenty years. This was the anticipated lifespan of the street lighting in their experiment. While locks and bolts may fall into disuse and disrepair more rapidly than routinely maintained street lighting, it is not unfeasible that they have an extremely long lifespan in some
instances. Lifetime guarantees are not uncommon for locks and other security hardware, and the lifespan of many locks will be limited only by the durability of their wooden frames.

*The Portfolio of Benefit-Cost Ratios*

The main variables from which the portfolio of measures were generated have been described above. The variation in the estimate of the value of a saved burglary were benefit measures BM1, BM2 and BM3. Three impact measures were described IM1, IM2, and IM3, and the three scenarios relating to returns over time were defined.

Table 5 shows the set of net benefits from which the benefit-cost ratios shown in Table 6 are calculated (after the division of each total benefit estimate by the total project cost of £109,131). Recall that the 95 percent confidence intervals around the net benefit and benefit-cost ratios are not shown and would be 15 percent either side of the values in Tables 5 and 6.

INSERT TABLES 5 and 6 ABOUT HERE: NET BENEFITS AND B-C RATIOS

There is a twenty-one fold variation in the benefit-cost ratio between the highest (78.75) and lowest (3.68) estimates. This is considerable. As with Painter and Farrington’s findings relating to street lighting, it is the estimated extent of returns over time that appears to have the most major effect. Within the benefit-cost ratios relating solely to
returns within the two years of the project, the highest estimate (16.41) is over four times the value of the lowest estimate (3.68).

The benefit-cost ratio is most sensitive to changes in the period over which returns were calculated, followed by change in the impact measure (the inclusion of displacement/diffusion and anticipatory benefits), then changes in the estimated benefits from a prevented burglary. Further sensitivity tests using other case studies will provide more information about which variables are most influential in the aggregate. However, it is clear that major variation in the cost-effectiveness of the crime reduction scheme is apparent depending on which variables are selected for inclusion in the benefit-cost ratio, and depending on which other parameters are chosen. Although this particular scheme produced positive returns in every case, it is easy to envisage a scenario in which some ratios are positive, some negative, and some close to unity.

DISCUSSION AND CONCLUSION

Perhaps the case could be made that a limited portfolio of benefit-cost ratios is simply an extension of traditional sensitivity analysis. Certainly it has many things in common with traditional sensitivity analysis: it tests the degree to which the benefit-cost ratio varies under different conditions. Yet we would suggest it is different insofar as it is a subject-specific proposal for a reformulation of the manner in which we use CBA as a tool to inform decision making in crime reduction and criminal justice. The evaluator providing a portfolio of outcomes becomes a service provider – providing information to policy-making customers – rather than a decision-maker contracted to one focal agency
providing ‘the’ single answer. Although such an orientation has arguably always been part of quality cost-benefit analysis it is typically, if unfortunately, honoured in the breach. And while there will always be some degree of subjectivity in evaluation research due to the fact that there will always be some choice of variables and method, improved transparency is always to be sought.

It is clear that the lifespan of crime reduction efforts is an important topic. The benefit-cost ratio proved extremely sensitive to change in the estimated lifespan of the crime reduction effort. There is scope for empirical research into the lifespan of crime reduction efforts: Perhaps questions could be included in the British Crime Survey that will shed light on the issue. It is an important issue for impact evaluation as well as cost-benefit analysis, although the orientation of CBA towards the inclusion of future costs and benefits helped identify its importance in the present instance.

There are more variables that could be varied than were included in the present case study. It was not possible to include data on national as opposed to local input costs. Likewise, only one set of estimates of the social benefit of burglary was utilised: the pioneering work of Brand and Price (2000) appear to have given them a monopoly in that field but it requires competition using alternative methods and sources if it is to prosper. Similarly, while a discount rate of 6 percent appears to be the default in the UK (as recommended HM Treasury’s ‘Green Book’), values of 3 or 4 percent more typically used in the US would increase the estimated benefits for the ten-year scenarios.
The optimal set of variables that are required for a particular study will vary with the type of evaluation and the availability of data as well as the nature of the audience. As cost-benefit analysis becomes commonplace in crime reduction and criminal justice research, perhaps there will be increasing standardisation in the production of multiple cost-benefit ratio outcomes.

Crime science should aim to be practical and to facilitate choice among consumers of CBA. Different consumers demand different cost-benefit measures. Most informed readers, policy-makers or their advisors can, or should be able to, interpret multiple benefit-cost ratios and their underlying rationale. The presentation of a single 'best' benefit-cost ratio, as so often occurs, has the superficial advantage of appearing both simple and definitive. It has the disadvantage of conveying limited information. The presentation of a long list of ratios has the advantage of presenting much information but the disadvantage of being unwieldy. There is a trade-off between a confusing over-provision of technical details and the overly-selective under-provision of limited information. The aim of this chapter is to suggest one direction towards a pragmatic compromise: a limited portfolio that conveys the most critical set of information in a readily comprehensible manner to a variety of audiences.
REFERENCES


### Table 1: A User-Specified Benefit-Cost Ratio

<table>
<thead>
<tr>
<th>A. Key Impact Evaluation Influences</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Include displacement costs:</td>
</tr>
<tr>
<td>a. Within project area</td>
</tr>
<tr>
<td>i. Targeted crime-type only</td>
</tr>
<tr>
<td>ii. Other crime-types</td>
</tr>
<tr>
<td>b. In other areas</td>
</tr>
<tr>
<td>i. Targeted crime-type only</td>
</tr>
<tr>
<td>ii. Other crime-types</td>
</tr>
<tr>
<td>c. Other (as appropriate)</td>
</tr>
<tr>
<td>2. Include diffusion of benefits:</td>
</tr>
<tr>
<td>a. Within project area</td>
</tr>
<tr>
<td>i. Targeted crime-type only</td>
</tr>
<tr>
<td>ii. Other crime-types</td>
</tr>
<tr>
<td>b. In other areas</td>
</tr>
<tr>
<td>i. Targeted crime-type only</td>
</tr>
<tr>
<td>ii. Other crime-types</td>
</tr>
<tr>
<td>c. Other (as appropriate)</td>
</tr>
<tr>
<td>3. Include anticipatory benefits:</td>
</tr>
<tr>
<td>a. Targeted crime-type only</td>
</tr>
<tr>
<td>b. Other (as appropriate)</td>
</tr>
<tr>
<td>4. Select confidence intervals for measure of impact</td>
</tr>
<tr>
<td>a. 95%</td>
</tr>
<tr>
<td>b. Other (please specify)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Pure Cost-Estimation Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Select input costs:</td>
</tr>
<tr>
<td>a. Local</td>
</tr>
<tr>
<td>b. National</td>
</tr>
<tr>
<td>c. Other (as appropriate)</td>
</tr>
<tr>
<td>6. Select cost of crime estimate:</td>
</tr>
<tr>
<td>a. Local cost of crime</td>
</tr>
<tr>
<td>b. National cost of crime</td>
</tr>
<tr>
<td>c. Other (as appropriate)</td>
</tr>
</tbody>
</table>
7. Include intangible costs (Yes/No)

8. Criminal Justice costs:
   a. Include ‘saved’ police time (Yes/No)
   b. Include other ‘saved’ cost items (Yes/No)
   c. Other (as appropriate)

9. Returns over time
   a. Select number of years for returns
   b. Using discounting rate x (advised value within range 3-6).
## Table 2: Input Costs for Midtown Burglary Reduction Scheme

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household target-hardening</td>
<td>£23,699</td>
</tr>
<tr>
<td>Educational scheme for householders</td>
<td>£89,678</td>
</tr>
<tr>
<td>Other situational measures (alley-gating)</td>
<td>£22,595</td>
</tr>
<tr>
<td>Intelligence operations and market-disruption efforts</td>
<td>£6,443</td>
</tr>
<tr>
<td><strong>Total Input Cost</strong></td>
<td><strong>£142,415</strong></td>
</tr>
<tr>
<td><em>Total Input Cost converted to April 1999 prices</em></td>
<td><em>£109,131</em></td>
</tr>
</tbody>
</table>
Table 3: Components of the Estimated Cost of a Burglary (from Brand and Price 2000)

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property stolen and damaged</td>
<td>£830</td>
</tr>
<tr>
<td>Emotional and physical</td>
<td>£550</td>
</tr>
<tr>
<td>Criminal Justice System (including police)</td>
<td>£490</td>
</tr>
<tr>
<td>Security expenditure</td>
<td>£330</td>
</tr>
<tr>
<td>Insurance administration</td>
<td>£100</td>
</tr>
<tr>
<td>Lost output</td>
<td>£40</td>
</tr>
<tr>
<td>Victim services</td>
<td>£4</td>
</tr>
<tr>
<td>Health services</td>
<td>£0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£2344</strong></td>
</tr>
</tbody>
</table>
Table 4: Impact Measures and Benefit Measures used to Derive Limited Portfolio of Outcomes

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Measure 1 (IM1)</td>
<td>Burglary prevented in scheme area</td>
<td>Mean = 308</td>
</tr>
<tr>
<td>Impact Measure 1 (IM1)</td>
<td>IM1 plus net displacement/diffusion effect of 37 further burglaries prevented</td>
<td>345</td>
</tr>
<tr>
<td>Impact Measure 1 (IM1)</td>
<td>IM2 plus net anticipatory benefit effect of 419 further burglaries prevented</td>
<td>764</td>
</tr>
<tr>
<td>Benefit Measure 1 (BM1)</td>
<td>All burglary cost items shown in Table 3</td>
<td>£2344</td>
</tr>
<tr>
<td>Benefit Measure 2 (BM1)</td>
<td>IM1 excluding emotional and physical cost of £550</td>
<td>£1794</td>
</tr>
<tr>
<td>Benefit Measure 3 (BM1)</td>
<td>IM2 excluding criminal justice or police costs of £490</td>
<td>£1304</td>
</tr>
</tbody>
</table>
Table 5: Multiple Estimates of Net Benefits

<table>
<thead>
<tr>
<th>Rate of Returns Scenario 1 (2 Years)</th>
<th>Benefit Measure 1 (£2344 per burglary)</th>
<th>Benefit Measure 2 (£1794 per burglary)</th>
<th>Benefit Measure 3 (£1304 per burglary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Measure 1: Project Area Only (308 burglaries prevented)</td>
<td>£612,821</td>
<td>£443,421</td>
<td>£292,501</td>
</tr>
<tr>
<td>Impact Measure 2: Including net displacement/diffusion (345 burglaries prevented)</td>
<td>£699,549</td>
<td>£509,799</td>
<td>£340,749</td>
</tr>
<tr>
<td>Impact Measure 3: Including net displacement/diffusion and anticipatory benefits (764 burglaries prevented)</td>
<td>£1,681,685</td>
<td>£1,261,485</td>
<td>£887,125</td>
</tr>
</tbody>
</table>

Rate of Return Scenario 2 (10% decline p.a. in burglary prevented = 938 burglaries prevented)

| Impact Measure 1: Project Area Only (938 burglaries prevented) | £2,089,541 | £1,573,641 | £1,114,021 |
| Impact Measure 2: Including net displacement/diffusion | £2,353,667 | £1,775,792 | £1,260,958 |
| Impact Measure 3: Including net displacement/diffusion and anticipatory benefits | £5,344,718 | £4,065,018 | £2,924,921 |

Rate of Return Scenario 3 (constant returns for a further 9 years = 1478 burglaries prevented)

| Impact Measure 1: Project Area Only (1478 burglaries prevented) | £3,355,301 | £2,542,401 | £1,818,181 |
| Impact Measure 2: Including net displacement/diffusion | £3,771,483 | £2,860,929 | £2,049,709 |
| Impact Measure 3: Including net displacement/diffusion and anticipatory benefits | £8,484,460 | £6,468,046 | £4,671,604 |
### Table 6: Limited Portfolio of Benefit-Cost Ratios

<table>
<thead>
<tr>
<th>Rate of Returns Scenario 1 (2 Years)</th>
<th>Benefit Measure 1 (£2344 per burglary)</th>
<th>Benefit Measure 2 (£1794 per burglary)</th>
<th>Benefit Measure 3 (£1304 per burglary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Measure 1: Project Area Only (308 burglaries prevented)</td>
<td>6.62</td>
<td>5.06</td>
<td>3.68</td>
</tr>
<tr>
<td>Impact Measure 2: Including net displacement/diffusion (345 burglaries prevented)</td>
<td>7.41</td>
<td>5.67</td>
<td>4.12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rate of Return Scenario 2 (10% decline p.a. in burglary prevented)</th>
<th>Benefit Measure 1 (£2344 per burglary)</th>
<th>Benefit Measure 2 (£1794 per burglary)</th>
<th>Benefit Measure 3 (£1304 per burglary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Measure 1: Project Area Only (938 burglaries prevented)</td>
<td>20.15</td>
<td>15.42</td>
<td>11.21</td>
</tr>
<tr>
<td>Impact Measure 2: Including net displacement/diffusion</td>
<td>22.57</td>
<td>17.27</td>
<td>12.55</td>
</tr>
<tr>
<td>Impact Measure 3: Including net displacement/diffusion and anticipatory benefits</td>
<td>49.98</td>
<td>38.25</td>
<td>27.80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rate of Return Scenario 3 (constant returns for a further 9 years)</th>
<th>Benefit Measure 1 (£2344 per burglary)</th>
<th>Benefit Measure 2 (£1794 per burglary)</th>
<th>Benefit Measure 3 (£1304 per burglary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Measure 1: Project Area Only (1478 burglaries prevented)</td>
<td>31.75</td>
<td>24.30</td>
<td>17.66</td>
</tr>
<tr>
<td>Impact Measure 2: Including net displacement/diffusion</td>
<td>35.56</td>
<td>27.22</td>
<td>19.78</td>
</tr>
<tr>
<td>Impact Measure 3: Including net displacement/diffusion and anticipatory benefits</td>
<td>78.75</td>
<td>60.27</td>
<td>43.81</td>
</tr>
</tbody>
</table>